# Complete Summary

## GUIDELINE TITLE

Strategies to prevent transmission of methicillin-resistant Staphylococcus aureus in acute care hospitals.

## BIBLIOGRAPHIC SOURCE(S)

Calfee DP, Salgado CD, Classen D, Arias KM, Podgorny K, Anderson DJ, Burstin H, Coffin SE, Dubberke ER, Fraser V, Gerding DN, Griffin FA, Gross P, Kaye KS, Klompas M, Lo E, Marschall J, Mermel LA, Nicolle L, Pegues DA, Perl TM, Saint S, Weinstein RA, Wise R, Yokoe DS. Strategies to prevent transmission of methicillin-resistant Staphylococcus aureus in acute care hospitals. Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S62-80. PubMed

## GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT



## SCOPE

### DISEASE/CONDITION(S)

Methicillin-resistant *Staphylococcus aureus* (MRSA)

### GUIDELINE CATEGORY

Diagnosis
Management
Prevention
Risk Assessment
Screening

## CLINICAL SPECIALTY

Critical Care
Infectious Diseases
Internal Medicine
Nephrology
Nursing
Preventive Medicine
Surgery

## INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Clinical Laboratory Personnel
Hospitals
Nurses
Physician Assistants
Physicians
Utilization Management

## GUIDELINE OBJECTIVE(S)

To highlight practical recommendations in a concise format designed to assist acute care hospitals in implementing and prioritizing their efforts to prevent transmission of methicillin-resistant *Staphylococcus aureus* (MRSA)

## TARGET POPULATION

Patients in acute care hospitals

## INTERVENTIONS AND PRACTICES CONSIDERED

1. Basic practices for prevention and monitoring of methicillin-resistant *Staphylococcus aureus* (MRSA) transmission including:
    - Conduct MRSA risk assessment
    - Implement MRSA monitoring program
    - Promote compliance with Centers for Disease Control and Prevention or World Health Organization hand-hygiene recommendations
    - Use contact precautions for MRSA-colonized or -infected patients
    - Ensure cleaning and disinfection of equipment and environment
    - Educate healthcare personnel and patients
    - Implement an alert system notifying clinical personnel of new cases of MRSA
    - Assign accountability
2. Special approaches for prevention of MRSA transmission in hospitals with unacceptably high MRSA rates including:
    - Implement an MRSA active surveillance testing program
    - Routinely bathe adult patients with chlorhexidine
    - MRSA decolonization therapy (e.g. 2% intranasal mupirocin with or without chlorhexidine

## MAJOR OUTCOMES CONSIDERED

- Incidence of central line–associated bloodstream infection caused by methicillin-resistant *Staphylococcus aureus* (MRSA)
- Proportion of *S. aureus* isolates resistant to methicillin Number of new cases of MRSA colonization or infection over a given period of time (incidence)
- Number of new cases of 1 or more specific types of MRSA infection (such as bacteremia) over a given period of time (incidence)
- Point prevalence survey(s) of MRSA colonization or infection
- Hospital- or community-onset MRSA
- Length of hospital stay
- Cost
- Morbidity
- Mortality
- Sensitivity and specificity of surveillance methods

# METHODOLOGY

## METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

## DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

For this compendium, the Society for Healthcare Epidemiology of America/Infectious Diseases Society of America (SHEA/IDSA) reviewed previously published guidelines and recommendations relevant to each section and performed computerized literature searches using PubMed. Searches of the English-language literature focused on human studies published after existing guidelines through 2007, using the subject headings listed in Table 2 of the Compendium document (see "Availability of Companion Documents" field).

## NUMBER OF SOURCE DOCUMENTS

Not stated

## METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

## RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

### Quality of Evidence*

I. Evidence from $\geq$1 properly randomized, controlled trial
II. Evidence from $\geq$1 well-designed clinical trial without randomization, from cohort or case-controlled analytic studies (preferably from >1 center), from multiple time-series studies, or from dramatic results of uncontrolled experiments

III. Evidence from opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees

*Adapted from the Canadian Task Force on the Periodic Health Examination.

**METHODS USED TO ANALYZE THE EVIDENCE**

Review of Published Meta-Analyses
Systematic Review

**DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

In evaluating the evidence regarding the prevention and monitoring of healthcare-associated infections (HAIs), the HAI Allied Task Force followed a process used in the development of other Infectious Diseases Society of America (IDSA) guidelines, including a systematic weighting of the quality of the evidence and the grade of recommendation (see the "Rating Scheme for the Strength of the Evidence" and "Rating Scheme for the Strength of the Recommendations" fields).

**METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

**DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) Standards and Practice Guidelines Committee convened experts in the prevention and monitoring of healthcare-associated infections (HAIs).

The HAI Allied Task Force met on 17 occasions via teleconference to complete the compendium. The purpose of the teleconferences was to discuss the questions to be addressed, make writing assignments, and discuss recommendations. All members of the HAI Allied Task Force participated in the preparation and review of the draft documents. The compendium was then submitted to a subgroup of the HAI Allied Task Force with implementation expertise that, through a series of additional teleconferences and communications, performed extensive editing and reformatting to create implementation-focused text.

**RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

**Strength of Recommendation***

A. Good evidence to support a recommendation for use
B. Moderate evidence to support a recommendation for use
C. Poor evidence to support a recommendation

*Adapted from the Canadian Task Force on the Periodic Health Examination.

**COST ANALYSIS**

A formal cost analysis was not performed and published cost analyses were not reviewed.

## METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

### Review and Approval Process

A critical stage in the development process is peer review. Peer reviewers are relied on for expert, critical, and unbiased scientific appraisals of the documents. The Society for Healthcare Epidemiology of America/Infectious Diseases Society of America (SHEA/IDSA) employed a process used for all SHEA/IDSA guidelines that includes a multilevel review and approval. Comments were obtained from several outside reviewers who complied with the SHEA/IDSA policy on conflict of interest disclosure. In addition, 8 stakeholder organizations provided comments on the document. Finally, the guideline was reviewed and approved by the IDSA Standards and Practice Guidelines Committee and the Board of Directors of the SHEA and the IDSA prior to dissemination.

# RECOMMENDATIONS

## MAJOR RECOMMENDATIONS

### Recommendations for Implementing Prevention and Monitoring Strategies

Recommendations for preventing and monitoring methicillin-resistant *Staphylococcus aureus* (MRSA) transmission are summarized below (also see Figure in the original guideline document). They are designed to assist acute care hospitals in prioritizing and implementing their MRSA transmission prevention efforts.

Each recommendation includes a ranking for the strength and the quality of evidence supporting it. Definitions of the levels of evidence (I-III) and grades of recommendation (A-E) are provided at the end of the "Major Recommendations" field.

These recommendations are primarily intended for the control of MRSA transmission in the setting of endemicity; however, they may also be appropriate for epidemic MRSA, with the exception of an accelerated time frame for implementation and the frequency at which outcomes are assessed. These recommendations are meant to be complementary to other general infection prevention measures, such as central line–associated bloodstream infection and ventilator-associated pneumonia "bundles."

### Basic Practices for Prevention of Methicillin-Resistant *Staphylococcus aureus* (MRSA): Recommended for All Acute Care Hospitals

*Components of an MRSA Transmission Prevention Program*

1. Conduct an MRSA risk assessment (**B-III**).
    - Conduct an MRSA risk assessment. This risk assessment provides a baseline for subsequent assessments and other data comparisons.
    - Types of data that can be useful in performing an MRSA risk assessment include the following:
        - The proportion of *S. aureus* isolates resistant to methicillin
        - The number of new cases of MRSA colonization or infection over a given period of time (incidence)
        - The number of new cases of 1 or more specific types of MRSA infection (such as bacteremia) over a given period of time (incidence)
        - Point prevalence survey(s) of MRSA colonization or infection

          **Note**: These and other MRSA metrics are discussed in greater detail in the "Performance Measures" section of the original guideline document.

    - Use findings from the risk assessment to develop the hospital's surveillance, prevention, and control plan and to develop goals to reduce MRSA acquisition and transmission.

2. Implement an MRSA monitoring program (**A-III**).
    - A program should be in place to identify and track patients from whom MRSA has been isolated from any clinical or active surveillance testing specimen.
    - A common detection strategy used by infection control programs includes a daily review of laboratory results to identify patients from whom MRSA has been isolated.
    - A common method of tracking MRSA is a line list or case count. The line list includes the first MRSA isolate, regardless of body site, per patient and includes isolates identified by clinical culture and active surveillance testing, when available. These isolates should be classified as either hospital- or community-onset MRSA by use of prespecified definitions, as described in the original guideline document. In addition, patients known to be MRSA colonized or infected on the basis of testing performed at another healthcare facility may be included in the line list. Additional information contained in the line list may include patient identification, date of collection of specimen from which MRSA was isolated, site from which specimen was obtained, and hospital location at time of collection. Subsequent MRSA isolates from an individual patient may also be included in the line list but should be labeled to avoid being counted as additional new cases. The line list will allow MRSA isolates to be monitored and evaluated at the unit/ward and organizational levels.
    - Outcome measures related to MRSA in hospitals are discussed in more detail in the original guideline document.

3. Promote compliance with Centers for Disease Control and Prevention or World Health Organization hand-hygiene recommendations (**A-II**).
    - Implement a hand-hygiene compliance program.

- Patient-to-patient transmission of MRSA commonly occurs through transient colonization of the hands of healthcare personnel, and some investigators have attributed reduced rates of MRSA among hospital inpatients to efforts made to improve hand-hygiene practices (Johnson et al., 2005; Gopal Rao et al., 2002).
- Hand-hygiene practices compliant with Centers for Disease Control and Prevention or World Health Organization guidelines are critical to MRSA transmission control and prevention. Evidence-based recommendations for implementation and assessment of hand-hygiene programs in healthcare settings have been published (Boyce & Pittet, 2002). The 2005 World Health Organization Guidelines on Hand Hygiene in Health Care are available online (World Alliance for Patient Safety, World Health Organization, 2005).
- Information on promoting compliance with hand hygiene can be found in many published materials, such as the Institute for Healthcare Improvement's "How-To Guide: Improving Hand Hygiene" (Institute for Healthcare Improvement, 2008).

4. Use contact precautions for MRSA-colonized or -infected patients (**A-II**).
    - Place patients with MRSA colonization or infection under contact precautions to help reduce patient-to-patient spread of the organism within the hospital (Siegel et al., 2008; Siegel et al., 2007).
        - Place patients in a single or private room when available. Cohorting of patients with MRSA colonization or infection is acceptable when a single or private room is not available. Cohorting does not eliminate the need for compliance with hand-hygiene guidelines and other infection prevention measures.
        - Wear a gown and gloves on entry into the patient's room.
        - Remove the gown and gloves before exiting the room.
        - Use appropriate hand hygiene on entering and exiting the patient's room. Wearing gloves does not eliminate the need for hand hygiene.
    - Address potential adverse events associated with contact precautions.
        - Educate healthcare personnel about isolation precautions, including the benefits and potential adverse effects associated with contact precautions.
        - Several uncontrolled studies have reported that patients in isolation are examined less frequently and for shorter periods, compared with those not in isolation (Kirkland & Weinstein, 1999; Saint et al., 2003; Evans et al., 2003). Some studies have reported significantly increased rates of depression and anxiety among these patients (Catalano et al., 2003).
        - Patients isolated specifically for MRSA colonization or infection were more likely to experience preventable adverse events, such as pressure ulcers, falls, or electrolyte imbalances, compared with nonisolated patients without MRSA colonization or infection (Stelfox, Bates, & Redelmeier, 2003).
        - Authors of these studies emphasized that additional studies are needed to confirm their findings. Some have also suggested that hospitals monitor adverse events potentially attributable to contact precautions (Diekema & Edmond, 2007).

        - These potential adverse events should not be considered justification to avoid the use of contact precautions but rather should serve as a reminder to ensure that patients under contact precautions receive adequate care.
        - Ensure that hospital culture and leadership support the proper use of and enforce adherence to contact precautions for MRSA.
        - Educate patients, families, and visitors about isolation precautions.
    - Criteria for discontinuation of contact precautions
        - The duration of contact precautions necessary for patients colonized or infected with MRSA remains an unresolved issue.
        - Studies have suggested that patients may have persistent carriage of MRSA for prolonged periods (median duration 8.5 months in one study [Scanvic et al., 2001]) and that MRSA shedding can be intermittent and thus may be missed if only a single surveillance culture is performed.
        - With regard to the duration of contact precautions, Healthcare Infection Control Practices Advisory Committee guidelines recommend the following:
            - When active surveillance testing is used to identify MRSA-colonized patients, contact precautions are to be continued throughout the duration of hospital stay; a reasonable approach to subsequent discontinuation would be to document clearance of the organism with 3 or more surveillance tests in the absence of antimicrobial exposure. (Siegel et al., 2006) When to consider retesting patients to document clearance is debatable, but 3 to 4 months after the last positive test result is commonly used as the time frame. Some hospitals may choose to consider MRSA-colonized patients to be colonized indefinitely.

5. Ensure cleaning and disinfection of equipment and the environment (**B-III**).
    - MRSA contaminates the patient's environment (e.g., over-bed tables, bed rails, furniture, sinks, and floors) (Hardy et al., 2006; Sexton et al., 2006; French et al., 2004; Lemmen et al., 2004; Oie, Hosokawa, & Kamiya, 2002; Rampling et al., 2001) and patient care equipment (e.g., stethoscopes and blood pressure cuffs) (Smith et al., 1996; Cohen et al., 1998; de Gialluly et al., 2006; Madar, Novakova, & Baska, 2005; Sengupta, Sirkar, & Shivananda, 2000). Exposure to this contaminated environment has been associated with acquisition of MRSA (Huang, Datta, & Platt, 2006).
    - Develop and implement protocols for cleaning and disinfecting environmental surfaces.
        - Select appropriate cleaning and disinfecting agents for environmental surfaces. Recent guidelines have outlined environmental disinfection protocols (Sehulster & Chinn, 2003). Routine cleaning and disinfection of the patient environment with US Environmental Protection Agency-registered hospital disinfectants (e.g., quaternary ammonium compounds, sodium hypochlorite, iodophors, and phenolics) used in accordance with the manufacturers' directions is adequate to reduce MRSA contamination.

        - Develop written protocols for daily and terminal cleaning and disinfection of patient rooms.
    - Pay close attention to cleaning and disinfection of frequently touched ("high-touch") surfaces in patient-care areas (e.g., bed rails, carts, bedside commodes, doorknobs, and faucet handles).
        - For terminal cleaning of rooms of patients colonized or infected with MRSA, pay special attention to ensuring adequate coverage of environmental surfaces with approved disinfectants at appropriate dilutions for the appropriate amount of contact time.
        - A system for monitoring adherence to environmental cleaning and disinfection protocols is desirable.
        - Develop and implement protocols for cleaning and disinfecting patient care equipment.
        - To reduce MRSA contamination, disinfect portable healthcare equipment, such as stethoscopes and otoscopes, with a 70% isopropyl alcohol swab or other disinfectant after each use.
    - Dedicate noncritical patient care items, such as blood pressure cuffs and stethoscopes, to a single patient when they are known to be colonized or infected with MRSA. When this is not possible, ensure adequate cleaning and disinfection of items between patient encounters.
    - Provide appropriate training for personnel responsible for cleaning and disinfecting the environment and patient care equipment.

6. Educate healthcare personnel about MRSA, including risk factors, routes of transmission, outcomes associated with infection, prevention measures, and local epidemiology (**B-III**).
    - Modify healthcare personnel behavior: Several key components of an effective MRSA transmission prevention program involve modification of healthcare personnel behavior (e.g., compliance with hand hygiene, contact precautions, environmental disinfection, and active surveillance testing protocols).
    - Provide an educational program to foster desired behavior changes (Seto, 1995) and include a discussion of MRSA risk factors, routes of transmission, outcomes associated with infection, prevention measures, local MRSA epidemiology (MRSA infection rates, etc.) and current data regarding healthcare personnel compliance with infection prevention and control measures.
    - Target educational programs on the basis of healthcare personnel needs (e.g., professional or nonprofessional). Given the wide range of educational backgrounds among hospital personnel, several educational programs will be needed to provide the information necessary at the appropriate level for all relevant personnel. Subsequent educational sessions and written communications may be of more limited scope and may include data related to MRSA process and outcome measures.
    - Including opinion leaders and role models in the educational and behavioral modification program may be useful.

7. Implement a laboratory-based alert system that immediately notifies infection prevention and control personnel and clinical personnel of new MRSA-colonized or -infected patients (**B-III**).
    - To place patients with MRSA colonization or infection under contact precautions in a timely manner, an alert system should be developed among the laboratory staff, infection prevention and control staff, and clinical personnel caring for the patient.
    - This alert system should notify infection prevention and control staff when a patient is identified as positive for MRSA. This can be accomplished via fax, phone, pager, or automated secure electronic alerts.

8. Implement an alert system that identifies readmitted or transferred MRSA-colonized or -infected patients (**B-III**).
    - An alert system allows information regarding the MRSA status of the patient to be available at the time of admission, before bed assignment.
    - Information may come from prior testing by the hospital system or from information supplied by a referring facility. This information may be integrated into the computerized database used during admission and registration or may exist as a separate electronic or paper-based database.
    - The alert should remain in effect until clearance of MRSA has been documented by subsequent culture or other forms of testing. (See the discussion regarding the duration of contact precautions above.)
    - Implement a system for communicating the MRSA status of a patient when transferring him/her to another hospital, so that appropriate precautions can be implemented at the accepting facility.

9. Provide MRSA data and outcome measures to key stakeholders, including senior leadership, physicians, and nursing staff (**B-III**).
    - The process and outcome measures outlined in the "Performance Measures" section of the original guideline document should be provided to appropriate hospital staff and administrators on a regular basis. The frequency with which these data are provided will depend on the hospital's existing reporting structure and the type of data collected. These data can be added to routine quality assessment and performance improvement reports.

10. Educate patients and their families about MRSA, as appropriate (**B-III**).
    - Education of the patient and the patient's family may help to alleviate patient fears regarding being placed into isolation (Lewis, Gammon, & Hosein, 1999).
        - Include information about anticipated questions: General information about MRSA, colonization versus infection, the hospital's MRSA transmission prevention program, the components of and rationale for contact precautions, and the risk of transmission to family and visitors while in the hospital and after discharge. Helpful methods might include patient education sheets in appropriate languages, patient education channels, Web sites, or video presentations.

*Accountability*

1. The hospital's chief executive officer and senior management are responsible for providing a healthcare system that supports an infection prevention and control program that effectively prevents healthcare-associated infections and the transmission of epidemiologically significant pathogens.
2. Senior management is accountable for ensuring that trained personnel are assigned to the infection prevention and control program.
3. Senior management is accountable for ensuring that healthcare personnel, including licensed and nonlicensed personnel, are competent to perform their job responsibilities.
4. Direct healthcare providers (such as physicians, nurses, aides, and therapists) and ancillary personnel (such as housekeeping and equipment-processing personnel) are responsible for ensuring that appropriate infection prevention and control practices are used at all times (including hand hygiene, standard and isolation precautions, and cleaning and disinfection of equipment and the environment).
5. Hospital and unit leaders are responsible for holding personnel accountable for their actions.
6. The person who manages the infection prevention and control program is responsible for ensuring that an active program for identifying MRSA is implemented, that data on MRSA are analyzed and regularly provided to those who can use the information to improve the quality of care (e.g., unit staff, clinicians, and hospital administrators), and that evidence- based practices are incorporated into the program.
7. Personnel responsible for healthcare personnel and patient education are accountable for ensuring that appropriate training and educational programs on preventing MRSA transmission are developed and provided to healthcare personnel, patients, and families.
8. Personnel from the infection prevention and control program, the laboratory, and information technology are responsible for ensuring that a system is in place to support the surveillance program.

**Special Approaches for the Prevention of MRSA Transmission**

Special approaches are recommended for use in locations and/or populations within the hospital that have unacceptably high MRSA rates despite implementation of the basic MRSA transmission prevention strategies listed above. There are several controversial issues regarding prevention of MRSA transmission. As a result, implementation of the recommendations beyond the basic practices to prevent MRSA transmission should be individualized at each healthcare facility. Facilities may consider a "tiered" approach in which recommendations are instituted individually or in groups; additional "tiers" are added if MRSA rates do not improve, with implementation of basic practices as the first tier.

*Active Surveillance Testing: MRSA Screening Program for Patients*

Active surveillance testing is based on the premise that clinical cultures identify only a small proportion of hospital patients who are colonized with MRSA and that asymptomatically colonized MRSA carriers serve as a substantial reservoir for person-to-person transmission of MRSA in the acute care hospital setting. Studies

have shown that routine use of clinical cultures alone does not identify the full reservoir of asymptomatically colonized patients, underestimating the overall hospital-wide prevalence of MRSA by as much as 85% (Salgado & Farr, 2006) and underestimating the monthly average prevalence of MRSA in ICUs by 18.6% to 63.5% (Huang et al., 2007). In addition, active surveillance testing can reduce misclassification of MRSA isolates by identifying patients who are already colonized at the time of admission, so that subsequent MRSA isolates are not falsely attributed to intrafacility acquisition (Huang et al., 2007).

The effectiveness of active surveillance testing in the prevention of MRSA transmission is currently an area of controversy, and optimal implementation strategies (including timing and target populations) are unresolved. Several published studies of high-risk or high-prevalence populations (including those in outbreak situations) have shown an association between the use of active surveillance testing to identify and isolate MRSA-colonized patients and the effective control of MRSA transmission and/or infection (West et al., 2006; Huang et al., 2006; Safdar et al., 2006; Lucet et al., 2005). Two recent studies evaluated the impact of universal active surveillance testing performed at the time of hospital admission combined with administration of decolonization therapy to MRSA carriers and came to conflicting conclusions. One study used an observational cohort design and reported a significant reduction in hospital-associated MRSA disease after the introduction of active surveillance testing of all patients and decolonization of MRSA carriers (Robiscek et al., 2008). The other study used a crossover cohort design and found no significant changes in the incidence of nosocomial MRSA infection among surgical patients (Harbarth et al., 2008). There are several possible explanations for the differences in outcome observed in these 2 studies, including differences in study design, patient population, adherence to routine infection control measures, and adherence to decolonization therapy protocols. Of note, a multicenter, cluster-randomized trial investigating the impact of active surveillance testing on MRSA in ICUs has been performed, but the results have not yet been published (ClinicalTrials.gov identifier NCT00100386).

This was a very complex study. Preliminary analysis did not demonstrate a benefit from active surveillance testing during the 6-month study period under the specific study protocol. The authors have stated that those preliminary results should not be used to conclude that active surveillance testing is useless or that efforts to control MRSA are futile (Huskins, 2007). The final analysis and peer review of study methods, results, and conclusions are pending.

Because of conflicting results from these studies and the differences among acute care hospitals and their associated patient populations, a specific recommendation regarding universal screening for MRSA cannot be made. However, active surveillance testing as a single intervention in the absence of a multifaceted approach to MRSA transmission prevention (e.g., the basic measures described above) is unlikely to be uniformly effective across healthcare institutions. Active surveillance testing may, however, be useful in facilities that have implemented and optimized adherence to basic MRSA transmission prevention practices but continue to experience unacceptably high MRSA rates.

1. Implement an MRSA active surveillance testing program as part of a multifaceted strategy to control and prevent MRSA transmission when

evidence suggests that there is ongoing transmission of MRSA despite effective implementation of basic practices (**B-II**).

Assess MRSA transmission as the basis for determining if, when, and where active surveillance testing is to be used at an individual hospital. In general, active surveillance testing is considered appropriate in a facility where there is direct or indirect evidence of ongoing MRSA transmission despite adequate implementation of and adherence to basic practices. Although the use of serial active surveillance testing of hospital patients provides the most accurate measurement of MRSA transmission, other metrics may be used as surrogate markers for transmission when comprehensive active surveillance testing data are not available. Examples include the following:

- A high or increasing prevalence or incidence of hospital-onset MRSA infection or colonization
- An incidence of hospital-onset MRSA infection or colonization that is not decreasing despite the use of basic practices
- An increasing proportion of hospital-onset *S. aureus* isolates that are resistant to methicillin
- Identification of specific hospital units in which the colonization pressure (i.e., the prevalence rate of MRSA) is above the level associated with an increased risk of transmission (Merrer et al., 2000). (Such units may be identified with the use of point prevalence surveys.)
- Identification of specific patient populations at high risk for MRSA colonization or infection

- Convene a multidisciplinary team to review the MRSA risk assessment and to plan and oversee the active surveillance testing program.
    - Because of the multidisciplinary nature of an active surveillance program, representatives from the microbiology laboratory, infection prevention and control personnel, nursing staff, medical staff, materials management, environmental services, and hospital administration should be involved in program development, implementation, and resource allocation. Careful consideration of the resources necessary for an active surveillance testing program is essential to ensure that the active surveillance testing program is implemented properly and that other important components of the hospital's infection control program are not disrupted.
    - Consultation with a trained individual who has expertise in MRSA transmission control and prevention may be useful for program development and assessment if such a person is not available within the hospital.
    - Pilot the program in one location before expanding to other locations. Select the pilot unit on the basis of the risk or prevalence of MRSA on the unit or the presence of motivated leadership and front-line personnel.
    - Expand the program to additional units once the pilot program has been evaluated and adjusted and initial goals have been met (e.g., more than 90% compliance with specimen acquisition).
- Select and identify the patient population(s) to be screened.

- Determine which patients to screen (e.g., all patients versus high-risk patients or patients on high-risk units).
    - Use the MRSA risk assessment to determine whether all patients, patients admitted to specific high-risk units (e.g., the ICU), or high-risk patient populations (regardless of location) will be included in the screening program.
    - Patient-level risk factors for MRSA colonization (e.g., recent admission to a hospital or skilled nursing facility, long-term hemodialysis, and recent antimicrobial therapy) may also be used to determine inclusion in the screening program (Haley et al., 2007).
    - Consider available infrastructure and hospital-specific characteristics (size; staffing for infection prevention and control, laboratory, and nursing; patient population; and information technology support) when selecting the patient population(s) to be screened.
- Develop and implement a system to identify and screen patients who meet the screening program criteria.
    - A reliable system for identification of all patients meeting the criteria for inclusion in the screening program is necessary for the success of the program.
    - Identification of patients who meet criteria for MRSA screening may be more difficult when patient-level risk factors, rather than patient care unit, are used to determine inclusion in the surveillance program. Take this into consideration during the planning stages of the screening program. Hospitals with well-developed electronic medical records and other computer databases may be able to identify such patients by use of a computer algorithm.
    - Consider developing and implementing a checklist to be completed at admission to assist in identifying patients to be screened for MRSA.
    - Determine how screening specimens will be ordered (e.g., protocol admission order set or individual patient order), who will initiate the order (e.g., physician or nurse) and who will obtain the specimens (e.g., unit-based nursing personnel or designated MRSA monitoring program personnel). These decisions will need to take into account relevant hospital policies, staffing, and infrastructure.
- Determine when to perform screening tests.
    - At a minimum, MRSA surveillance should be performed at admission to the hospital or to the specific unit in which surveillance is being performed.
    - To detect transmission while in the hospital, additional testing of patients with initial negative surveillance test results can be done either at regular intervals (e.g., weekly) or at discharge from the hospital or unit.
    - Testing at regular intervals has the potential to detect patients who have acquired MRSA during their hospitalization earlier than testing only at discharge and thus allows implementation of contact precautions to prevent further transmission.
    - When testing is to be performed at regular intervals, determine a specific day of the week when specimens will be collected. This will

simplify the process and allow the microbiology laboratory to anticipate the increased volume of specimens and plan staffing and supplies accordingly.

- Determine the anatomic sites to include in screening program.
    - Identify the anatomic site(s) to be tested.
        - Anterior nares: The sensitivity of surveillance specimens obtained from a variety of sites has been evaluated in several settings and patient populations. Although testing of no single site will detect all MRSA-colonized persons, the anterior nares appear to be the most frequently positive site, with sensitivity ranging from 73% to 93% (Manian et al., 2002; Sanford et al., 1994; Cox et al., 1995; Lucet et al., 2003; Eveillard et al., 2006; Rohr et al., 2004; Girou et al., 1998). Because of this and the accessibility of the site, the anterior nares are generally considered to be the primary site for sampling in MRSA screening programs.
        - Collection of samples from other sites, such as wounds, foreign body (e.g., gastrostomy or tracheostomy tube) exit sites, the throat, the perianal area, and/or the umbilicus (in neonates) (Rosenthal et al., 2006) will allow identification of additional colonized patients who would not be identified by testing of nasal specimens alone.
- Determine laboratory methods and assess resource requirements.
    - Identify the screening test method to be used.
    - MRSA can be detected using culture-based methods or molecular diagnostic testing methods, such as polymerase chain reaction (PCR). Many factors must be considered when determining which laboratory method(s) will be used in an MRSA screening program. These factors include but are not limited to the following:
        - Performance characteristics of the test (e.g., sensitivity and specificity)
        - Turnaround time
        - Capabilities of the laboratory (whether an in-house or reference laboratory) that will be providing the service
        - Number of specimens that will be processed
        - Facility-specific cost-benefit calculations
    - A detailed discussion of the various laboratory methods for MRSA detection is beyond the scope of this document, but some of the key features of the most common methods are discussed below.
        - Culture-based methods: Culture-based techniques have been used in the majority of MRSA screening programs. Numerous microbiological media and techniques have been described for use in the detection of MRSA colonization. One of the more commonly used selective media is mannitol salt agar with or without antimicrobial (e.g., oxacillin or cefoxitin) supplementation to increase specificity for methicillin-resistant organisms. Additional enrichment steps, such as overnight incubation in trypticase soy broth, can further increase the yield of standard culture-based methods (Safdar et al., 2003). The time required for detection of MRSA by use of most culture-based techniques is approximately 48 hours. More recently, several chromogenic agar media have been developed that allow more rapid detection of MRSA, usually within 24 hours.

Studies using established collections of isolates and clinical specimens have shown that these chromogenic media rival or outperform more conventional microbiological techniques (Diederen et al., 2005; Diederen et al., 2006; Flayhart et al., 2005; Stoakeset al., 2006; Perry et al., 2004; Han et al., 2007; Louie et al., 2006; Ben Nsira, Dupuis, & Leclerq, 2006; Smyth & Kahlmeter, 2005).

- Molecular testing methods: In recent years, there have been advances in molecular diagnostic testing methods, such as real-time PCR, for detection of MRSA colonization. At least 2 PCR assays for direct detection of MRSA in nasal specimens have been approved for use. These PCR assays have been shown to be highly sensitive (90% to 100%) and specific (91.7% to 98.4%), compared with standard culture-based methods (Huletsky et al., 2005; Warren et al., 2004; Bishop et al., 2006; Drews et al., 2006). Although it is more costly than culture-based techniques, one potential advantage of this technology is its ability to provide a result less than 2 hours from the time of specimen collection, although in actual practice the turnaround time may be longer because of batching of samples. Although at least 1 uncontrolled study (Cunningham et al., 2007) and a mathematical model (Bootsma, Diekmann, & Bonten, 2006) have suggested that rapid testing may allow for more effective use of isolation precautions and enhanced prevention of MRSA transmission, a recently published cluster-randomized crossover trial of universal screening in general wards failed to identify a difference in MRSA acquisition rates with the use of rapid testing, compared with the use of a culture-based method (Jeyaratman et al., 2008). These data suggest that the clinical and economic benefits of rapid testing may vary among individual hospitals and settings.

- Clarify how to manage patients while awaiting the results of screening tests.
  - Before implementing a screening program, a decision should be made as to how a patient will be managed while waiting for the result of the admission MRSA screening test. There are 2 common approaches:
    - Await the screening test result and implement contact precautions only if the test result is positive.
    - Place the patient under empirical contact precautions until a negative admission screening test result is documented.
  - Implementing contact precautions at the time of receipt of a positive screening test result is a reasonable initial approach. Although empirical contact precautions minimize the risk of MRSA transmission from unrecognized sources and have been shown to contribute to effective control of MRSA (Safdar et al., 2006), logistical difficulties are associated with this approach. Empirical use of contact precautions substantially increases the need for single rooms and the amount of supplies needed to practice contact precautions. When only a small proportion of screened patients are colonized with MRSA and single rooms are of limited quantity, a large number of patients whose screening test results are negative will need to be moved so that their single room can be used for another patient. These room reassignments and the necessary cleaning before the vacated room

can be reoccupied can slow down patient flow within the hospital. The empirical use of contact precautions for all tested patients while awaiting test results may be most feasible in hospitals in which a relatively large proportion of patient rooms are single rooms and in individual hospital units, such as many ICUs, in which each patient is in an individual room or bay. Despite its potential logistical difficulties, this approach should be considered if transmission continues despite introduction of a screening program in which contact precautions are implemented only after a positive MRSA screening test result is obtained.

- Assess the availability of single rooms and, if needed, plan for cohorting colonized or infected patients.
    - When developing a screening program, address the availability of single rooms for MRSA-positive patients, including cohorting persons colonized or infected with the same organism, when single rooms are not available. Consider the following:
        - Prioritize MRSA-positive patients who are at greater risk for transmission (e.g., those with draining wounds) for a single room.
        - Ensure that patients who are known or suspected to have other indications for isolation precautions (e.g., colonization or infection with other multidrug-resistant organisms, influenza, or tuberculosis) are not cohorted with MRSA-positive patients.
        - Cohorting does not eliminate the need for full compliance with hand hygiene and other basic prevention recommendations.
- Assess the availability of personal protective equipment and other supplies.
    - Ensure that gowns, gloves, and hand-hygiene products (e.g., alcohol-based hand rubs, soap, and paper towels) are consistently available to healthcare personnel. The screening program will not be effective if healthcare personnel are not able to comply with contact precautions because of a lack of supplies.
        - Cooperation among the purchasing department, laundry/linen service (if reusable gowns are selected), and unit-based personnel is imperative.
        - Infection prevention and control experts, particularly those familiar with the use of active surveillance, can serve as a resource to help hospitals estimate the number of patients likely to be found to be colonized with MRSA and, thus, the amount of supplies needed.
- Assess compliance with the screening protocol.
    - Monitor compliance with the screening and contact precautions protocols, because suboptimal compliance will prevent the surveillance program from providing its maximal benefit. The monitoring program should ensure that the following measures are taken:
        - Screening tests are collected and processed according to protocol.
        - Infection prevention and control personnel are notified of positive results within the proper time frame.
        - The clinical personnel caring for the patient are notified of positive results within the proper time frame.

Screening of healthcare personnel for MRSA is not routinely recommended in settings of endemicity unless they have been epidemiologically linked to new MRSA cases. Screening of healthcare personnel for MRSA should be considered in an outbreak setting.

1. Screen healthcare personnel for MRSA infection or colonization only if they are epidemiologically linked to a cluster of MRSA infections (**B-III**).
    - Healthcare personnel can become transiently or persistently colonized with MRSA, and this has been determined to be the source of several outbreaks in hospitals. Molecular testing (e.g., pulse-field gel electrophoresis) to establish clonality of MRSA isolates has been useful in such situations (Bertin et al., 2006; Stein et al., 2006; Meier et al., 1996; Wang et al., 2001, Blok et al., 2003).

*Routine Bathing with Chlorhexidine*

Recent studies have demonstrated that the use of chlorhexidine for routine cleansing of adult ICU patients may decrease the incidence of patient acquisition of MRSA (Climo et al., 2007) and vancomycin-resistant *Enterococcus* (Vernon et al., 2006) and may reduce the incidence of catheter-associated bloodstream infections (Bleasdale et al., 2007). The effect of chlorhexidine on transmission of bacterial pathogens is likely due to a reduction in the burden of organisms on the skin of colonized or infected patients, with a subsequent reduction in contamination of environmental surfaces and the hands of healthcare workers (Vernon et al., 2006). The use of chlorhexidine for routine patient cleansing outside of the adult ICU setting has not been studied.

1. Routinely bathe adult ICU patients with chlorhexidine (**B-III**).
    - Use chlorhexidine rather than regular soap and water or other nonmedicated cleansing regimens for routine patient cleansing.
    - A variety of chlorhexidine products that could be used for patient bathing are available. These include single-use bottles of aqueous chlorhexidine that can be added to a basin of water and 2% chlorhexidine-impregnated cloths. It should be noted that the use of undiluted 4% aqueous chlorhexidine solution for skin cleansing has been associated with a relatively high rate of reversible adverse skin effects (e.g., skin fissures, itching, and burning of the skin) (Wendt et al., 2007).
    - When using chlorhexidine, the manufacturer's recommendations should be followed. Care must be taken to avoid contact with the eyes and middle ear (e.g., in patients with perforated tympanic membranes). Chlorhexidine is in US Food and Drug Administration Pregnancy Category C.

*MRSA Decolonization Therapy for MRSA-Colonized Persons*

MRSA decolonization therapy can be defined as the administration of topical antimicrobial or antiseptic agents, with or without systemic antimicrobial therapy, to MRSA-colonized persons for the purpose of eradicating or suppressing the carrier state. The use of MRSA decolonization therapy in conjunction with active surveillance testing may be a useful adjunctive measure for prevention of MRSA transmission within a hospital. For example, one group of investigators observed a

52% reduction in incident cases of MRSA colonization or infection among adult ICU patients after the introduction of a decolonization regimen for all MRSA-colonized patients (Ridenour et al., 2007). Decolonization therapy has also been a component of several successful MRSA outbreak control programs (Saiman et al., 2003; Nambiar, Herwaldt, & Singh, 2003; Hitomi et al., 2000).

Decolonization therapy has also been used in certain patient populations in an attempt to reduce the risk of subsequent *S. aureus* infection among colonized persons. These populations have included patients undergoing dialysis (Herwaldt, 1998), patients with recurrent *S. aureus* infections, and patients undergoing certain surgical procedures (Kluytmans et al., 1996). Further discussion of this topic is beyond the scope of this document.

1. Provide decolonization therapy to MRSA-colonized patients in conjunction with an active surveillance testing program (**B-III**).
    - The optimal decolonization therapy regimen has not been determined. Most experience has been with the use of 2% mupirocin administered intranasally with or without chlorhexidine bathing. In the previously mentioned study that observed a reduction in incident cases of MRSA colonization or infection after the introduction of decolonization therapy, the decolonization regimen consisted of intranasal administration of 2% mupirocin twice daily for 5 days and chlorhexidine baths for 7 days (Ridenour et al., 2007). In that study, bed baths were performed after adding a 4-oz bottle of 4% chlorhexidine gluconate to a 6-qt basin of warm water.
    - Complications of decolonization therapy are relatively uncommon; however, hospital personnel involved in the decolonization therapy program should be familiar with potential adverse effects, such as development of resistance to the agents used (e.g., mupirocin) and drug-related toxicities.

**Unresolved Issues**

There are a number of unresolved issues related to MRSA and its transmission. A full discussion of these issues is beyond the scope of this document, but a brief mention of some of these important topics is worthwhile. For example, the impact of antimicrobial stewardship efforts on the risk of MRSA infection and transmission has not been clearly defined. Also, further study of the epidemiology and prevention of MRSA transmission among family members and other close contacts of persons colonized or infected with MRSA is needed. Additionally, the emergence of community-associated MRSA has further complicated the epidemiology of MRSA in healthcare facilities and has generated new questions related to MRSA transmission prevention in hospitals. One such topic that requires further study is the approach to detection of carriers of community-associated MRSA. Current approaches that are largely based on the epidemiology of hospital-associated MRSA may be suboptimal, given differences in risk factors for colonization and the presence of some evidence that suggests that there are differences in the predominant sites of colonization, compared with hospital-associated MRSA. Differences in antimicrobial susceptibility and virulence between typical hospital-associated MRSA and community-associated MRSA suggest that the phenotypic characteristics (e.g., antimicrobial susceptibility) of MRSA isolates from individual patients may need to be considered when it becomes necessary to cohort patients

with MRSA colonization or infection. These and other aspects of MRSA transmission and control require further investigation.

**Definitions**:

**Quality of Evidence***

I. Evidence from ≥1 properly randomized, controlled trial
II. Evidence from ≥1 well-designed clinical trial without randomization, from cohort or case-controlled analytic studies (preferably from >1 center), from multiple time-series studies, or from dramatic results of uncontrolled experiments
III. Evidence from opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees

**Strength of Recommendation***

A. Good evidence to support a recommendation for use
B. Moderate evidence to support a recommendation for use
C. Poor evidence to support a recommendation

*Adapted from the Canadian Task Force on the Periodic Health Examination.

## CLINICAL ALGORITHM(S)

An algorithm is provided in the original guideline document for Approach to Control and Prevention of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Transmission.

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

## REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

## TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

The recommendations in this guideline are largely based on previously published healthcare-associated infection (HAI) prevention guidelines available from a number of organizations, including the Healthcare Infection Control Practices Advisory Committee and the Centers for Disease Control and Prevention, Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Association for Professionals in Infection Control and Epidemiology, and relevant literature published after these guidelines.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

Improved strategies to prevent transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) in acute care hospitals

### POTENTIAL HARMS

- *Contact precautions*. Some studies have reported significantly increased rates of depression and anxiety among patients in isolation. In addition, these patients were more likely to experience preventable adverse events, such as pressure ulcers, falls, or electrolyte imbalances, compared with nonisolated patients without methicillin-resistant *Staphylococcus aureus* (MRSA) colonization or infection.
- *Chlorhexidine*. When using chlorhexidine, the manufacturer's recommendations should be followed. Care must be taken to avoid contact with the eyes and middle ear (e.g., in patients with perforated tympanic membranes). Chlorhexidine is in US Food and Drug Administration Pregnancy Category C.
- *Decolonization therapy*. Complications of decolonization therapy are relatively uncommon; however, hospital personnel involved in the decolonization therapy program should be familiar with potential adverse effects, such as development of resistance to the agents used (e.g., mupirocin) and drug-related toxicities.

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

- Recommendations that might ordinarily be included in a guideline with a C-level strength of recommendation were excluded from the recommendations and are discussed in the "unresolved issues" sections (see original guideline document); this was done to help hospitals to focus their implementation efforts on the most strongly recommended prevention practices. Hospitals can prioritize their efforts by initially focusing on implementation of the prevention approaches listed as basic practices recommended for all acute care hospitals. If healthcare-associated infection (HAI) surveillance or other risk assessments suggest that there is ongoing transmission despite implementation of basic practices, hospitals should then consider adopting some or all of the prevention approaches listed under the "special approaches" section of this document. These can be implemented within specific locations or patient populations or can be implemented hospital wide, depending on outcome data, risk assessment, and/ or local requirements. Most of the special approaches listed in this document are supported by studies based on the control of HAI outbreaks and require additional personnel and financial resources for implementation.
- These recommendations are primarily intended for the control of methicillin-resistant *Staphylococcus aureus* (MRSA) transmission in the setting of endemicity; however, they may also be appropriate for epidemic MRSA, with the exception of an accelerated time frame for implementation and the

frequency at which outcomes are assessed. These recommendations are meant to be complementary to other general infection prevention measures, such as central line–associated bloodstream infection and ventilator-associated pneumonia "bundles."

- There are several controversial issues regarding prevention of MRSA transmission. As a result, implementation of the recommendations beyond the basic practices to prevent MRSA transmission should be individualized at each healthcare facility.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

### IMPLEMENTATION TOOLS

Audit Criteria/Indicators
Clinical Algorithm
Foreign Language Translations
Patient Resources

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Staying Healthy

### IOM DOMAIN

Effectiveness
Patient-centeredness
Safety

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Calfee DP, Salgado CD, Classen D, Arias KM, Podgorny K, Anderson DJ, Burstin H, Coffin SE, Dubberke ER, Fraser V, Gerding DN, Griffin FA, Gross P, Kaye KS, Klompas M, Lo E, Marschall J, Mermel LA, Nicolle L, Pegues DA, Perl TM, Saint S, Weinstein RA, Wise R, Yokoe DS. Strategies to prevent transmission of methicillin-resistant Staphylococcus aureus in acute care hospitals. Infect Control Hosp Epidemiol 2008 Oct;29 Suppl 1:S62-80. PubMed

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

## DATE RELEASED

2008 Oct

## GUIDELINE DEVELOPER(S)

Infectious Diseases Society of America - Medical Specialty Society
Society for Healthcare Epidemiology of America - Professional Association

## SOURCE(S) OF FUNDING

Society for Healthcare Epidemiology of America (SHEA)/Infectious Diseases Society of America (IDSA)

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Healthcare-Associated Infections Task Force

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## FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

All members of the Healthcare-Associated Infections (HAI) Allied Task Force and the external peer reviewers complied with the Infectious Diseases Society of America (IDSA) policy on conflicts of interest, which requires disclosure of any financial or other interest within the past 2 years that might be construed as constituting an actual, potential, or apparent conflict. Members of the HAI Allied Task Force and the external reviewers were provided with the IDSA conflicts of interest disclosure statement and were asked to identify ties to companies developing products that might be affected by promulgation of the compendium. Information was requested regarding employment, consultancies, stock ownership, honoraria, research funding, expert testimony, and membership on company advisory committees. The task force made decisions on a case-by-case basis as to whether an individual's role should be limited as a result of a conflict.

D.S.Y. has received a research grant from Sage Products. L.A.M. has received research grants from and served as a consultant to 3M, Angiotech, and Cadence and is a consultant to Ash Access Technology. D.J.A. has received a research grant from Pfizer and has served on advisory councils for Schering-Plough and Pfizer. K.M.A. is the immediate past president of the Association for Professionals in Infection Control and Epidemiology and serves on its board of directors. H.B.'s participation does not represent official endorsement of the compendium by the National Quality Forum. D.P.C. is a member of the speakers' bureau for Enturia. S.E.C. has received a research grant from Merck. E.R.D. is a member of the speakers' bureaus for Elan, Enzon, Schering-Plough, Viropharma, Pfizer, and

Astellas and serves on the advisory boards of Schering-Plough, Genzyme, and Salix. V.F. is the past president of the Society for Healthcare Epidemiology of America, has been a consultant to Steris, Verimetrix, and Merck, and is a member of the speakers' bureaus for Cubist and Merck. P.G. has received a research grant from Becton, Dickinson and Company (BD); has been on the speakers' bureau for Ortho-McNeil; and served on the Zostervax advisory board of Merck. K.S.K has received research grants from Pfizer, Merck, and Cubist; is a member of the speakers' bureaus for Pfizer, Merck, Cubist, Schering-Plough, and Wyeth; and serves on the advisory board for Schering-Plough. J.M. has received a research grant from the Swiss National Science Foundation. T.M.P. is a past president of the Society for Healthcare Epidemiology of America; is on the advisory board or the speakers' bureau for Theradoc, 3M, Replydine, and Ortho-McNeil; and has received honoraria from VHA and the Institute for Healthcare Improvement. S.S. has received an honorarium from VHA. C.D.S. is a member of the speakers' bureau for Pfizer. R.A.W. has received research grants from Sage Products and the Centers for Disease Control and Prevention and has been a consultant on Tolevamer for Genzyme and a consultant to the Centers for Disease Control and Prevention. D.C. is co-chair of the National Quality Forum Patient Safety Taxonomy Committee and an employee of CSC, a healthcare technology consulting company, and has ownership in Theradoc, a medical software company. All other authors report no relevant conflicts of interest.

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American Organization of Nurse Executives - Professional Association
Association for Respiratory Care - Professional Association
Infusion Nurses Society - Professional Association
Pediatric Infectious Diseases Society - Professional Association
Society for Hospital Medicine - Professional Association
Society of Critical Care Medicine - Professional Association
Surgical Infection Society - Professional Association

## GUIDELINE STATUS

This is the current release of the guideline.

## GUIDELINE AVAILABILITY

Electronic copies: Available from the Society for Healthcare Epidemiology of America (SHEA) Web site.

Print copies: Available from the Reprints Coordinator, University of Chicago Press, 1427 E. 60th St., Chicago, IL 60637 (reprints@press.uchicago.edu) or contact the journal office (iche@press.uchicago.edu).

## AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Improving patient safety through infection control: a new healthcare imperative. Infect Control Hosp Epidemiol 2008;29:S3–S11. Electronic copies:

Available from the Society for Healthcare Epidemiology of America (SHEA) Web site.

- A compendium of strategies to prevent healthcare-associated infections in acute care hospitals. Executive summary. Infect Control Hosp Epidemiol 2008;29:S12–S21. Electronic copies: Available from the Society for Healthcare Epidemiology of America (SHEA) Web site.

Print copies: Available from the Reprints Coordinator, University of Chicago Press, 1427 E. 60th St., Chicago, IL 60637 (reprints@press.uchicago.edu) or contact the journal office (iche@press.uchicago.edu).

Performance measures and a urinary catheter reminder form (in appendix) are available in the original guideline document.

## PATIENT RESOURCES

The following is available:

- FAQs (frequently asked questions) about transmission of methicillin-resistant Staphylococcus aureus. 2008. 1 p.

Electronic copies: Available in English and Spanish from the Society for Healthcare Epidemiology of America (SHEA) Web site.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

## NGC STATUS

This NGC summary was completed by ECRI Institute on January 22, 2009. The information was verified by the guideline developer on March 30, 2009.

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